Project Introduction

The RINGS project (Resonant Inductive Near-field Generation Systems) was a DARPA-funded effort to demonstrate Electromagnetic Formation Flight and wireless power transfer in microgravity. Integration inconsistencies in both hardware and software prevented the experiment from achieving its objectives during the planned test sessions. A later project supported by NASA ARC focused on the assessment, diagnostics, corrections and ground testing of RINGS, to understand the reasons for the failure of RINGS to complete its science sessions, and assess the possibility of correcting these errors in future missions. The assessment concluded that RINGS can be successfully used in future science sessions provided that a new metrology system is available to navigate RINGS in real time onboard ISS. The proposed study supports the implementation, integration and ground testing of vision-based navigation of RINGS, using the Smartphone Video Guidance Sensor (SVGS) with SPHERES (Synchronized Position Hold Engage and Reorient Experimental Satellite). SVGS was developed at NASA MSFC for application on cubesats and small satellites to enable autonomous rendezvous and capture, and formation flying. SPHERES are free-flying robots that have been used for numerous experiments on board ISS. Their metrology system is based on ultrasonic beacons, and does not operate correctly with large flyers due to multi-path signal reflections. The main objective of this study is the integration of SVGS (as vision-based position and attitude sensor) with the SPHERES GN&C environment. Successful integration will be demonstrated by 3DOF vision-based guidance, navigation and motion control experiments on a flat floor using the RINGS ground units available at Florida Tech. Performance assessment will be done by a vision-based metrology system based on data fusion using high resolution cameras. A path forward for deployment on ISS will be developed in coordination with NASA ARC.

Vision-Based Navigation for Formation Flight onboard ISS, Phase I Briefing Chart Image

Table of Contents

Primary U.S. Work Locations and Key Partners

Organizations Performing Work	Role	Type	Location
Jaycon Systems	Lead Organization	Industry Minority-Owned Business	Melbourne, Florida
●Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California
Florida Institute of Technology	Supporting Organization	Academia	Melbourne, Florida

Primary U.S. Work Locations	
California	Florida

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Jaycon Systems

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
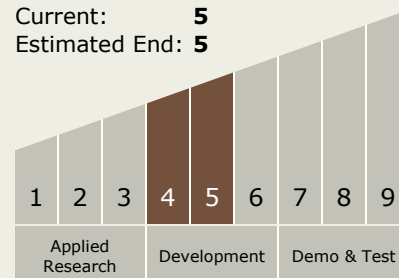
Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Hector Gutierrez

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**

Tech Port

Printed on 12/06/2022
07:56 PM UTC

For more information and an accessible alternative, please visit:
https://techport.nasa.gov/view/93831

Page 2

Images

Briefing Chart Image
Vision-Based Navigation for
Formation Flight onboard ISS,
Phase I Briefing Chart Image
*(https://techport.nasa.gov/imag
e/127735)*

Technology Areas

Primary:

- TX04 Robotic Systems
  └ TX04.5 Autonomous
    Rendezvous and Docking
    └ TX04.5.1 Relative
      Navigation Sensors

Target Destinations

The Sun, Earth, The Moon,
Mars, Others Inside the Solar
System, Outside the Solar
System